

**(54) PREPARATION OF MARINE FISH-PASTE PRODUCT**

- (11) 60-70049 (A) (43) 20.4.1985 (19) JP  
 (21) Appl. No. 58-180024 (22) 28.9.1983  
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 (51) Int. Cl. A23L1/325

**PURPOSE:** To prepare a marine fish-paste product having high ratio of deformation, and improved taste, by shearing and grinding frozen ground fish without thawing it.

**CONSTITUTION:** In grinding frozen ground fish, it is sheared and ground directly in a frozen state, preferably by adding previously salt and other subsidiary raw materials to it, starting grinding at  $\leq -20^{\circ}\text{C}$  temperature of frozen ground fish.

**(54) PREPARATION OF POWDER OF CRAB**

- (11) 60-70050 (A) (43) 20.4.1985 (19) JP  
 (21) Appl. No. 58-176516 (22) 26.9.1983  
 (71) TAKUYOU SUISAN KOGYO K.K. (72) IWA O SHIMIZU(1)  
 (51) Int. Cl. A23L1/33

**PURPOSE:** To prepare powder of crab useful as various processed foods and a food additive, having flavor and fragrance of crab of its own, by sterilizing crabs by boiling and steaming, drying them, and pulverizing.

**CONSTITUTION:** The whole landed crabs are boiled, sterilized primarily, washed with water, and the crabs are put in a refrigerator, preserved in the refrigerator at  $-5 \sim -15^{\circ}\text{C}$ . Carapaces and gills of crabs are removed, the crabs are washed with water, sprayed with steam at about  $90 \sim 100^{\circ}\text{C}$  for about 15~20min, sterilized secondarily, immediately dried, and pulverized.

**(54) PREPARATION OF POWDER OF ADLAY USEFUL AS COFFEE SUBSTITUTE**

- (11) 60-70051 (A) (43) 20.4.1985 (19) JP  
 (21) Appl. No. 58-108313 (22) 15.6.1983  
 (71) TAJIYUUROU UENO (72) TAJIYUUROU UENO  
 (51) Int. Cl. A23L2/38//A61K35/78

**PURPOSE:** To prepare powder of adlay useful as coffee substitute having a good balanced taste of fragrance and bitterness of adlay KOJI of its own, and high nutritive value, by using adlay KOJI obtained by processing adlay into a KOJI as a raw material.

**CONSTITUTION:** Polished adlay is washed with water, dried, powdered, decocted lightly by a decocting pot, steamed by a steamer, transferred to a warm bed, spread, the temperature of the steamed adlay is lowered to about  $35^{\circ}\text{C}$ , a seed KOJI is added to the whole adlay, it is processed into a KOJI in a KOJI chamber at about  $28^{\circ}\text{C}$ , the formed adlay KOJI is dried at  $150 \sim 200^{\circ}\text{C}$ , and powdered.

## ⑫ 公開特許公報(A)

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⑤ Int.Cl.<sup>4</sup>

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⑮ 特 願 昭58-180024

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## 明 細 書

## 1. 発明の名称

水産ねり製品の製造法

## 2. 特許請求の範囲

冷凍すり身をらいかい開始時の品温を $-20^{\circ}\text{C}$ 以下で凍結状態のまま、せん断らいかいすることを特徴とする水産ねり製品の製造法。

## 3. 発明の詳細な説明

水産ねり製品は我国古来の伝統食品であり、魚肉を食塩その他の原料とらいかい機で混練して製するのが従来からの方法であった。最近、らいかい機に替って、高速回転刃を有する各種カッターが使用される様になったが、らいかい機とその作用効果については同様である。即ち、魚肉を食塩と混練することにより、塩溶性蛋白が溶出して粘稠な魚肉ペーストが得られ、これを任意に成型した後加熱することにより、当初の魚肉とは異なる弾力性に富む製品が得られる。

原料の魚肉は、従来は魚体から採肉し、要すれば更に水晒し、脱水した魚肉を直接原料として使

用した。しかし最近では、かかる魚肉を直接原料とすることは極めて稀となり、通常は産地において魚体処理し、急速凍結した「冷凍すり身」を原料として使用している。

「冷凍すり身」は $-20^{\circ}\text{C}$ 以下で流通し、これを使用するときは冷蔵庫内、若しくは室温中に静置し、あるいは電磁波解凍機で加熱するなどして解凍した後らいかいに供する。特にらいかい機でらいかいする場合は、品温が $+3^{\circ}\text{C}$ より高くなっていないと、食塩の添加により $2^{\circ}\text{C}$ 程度品温が低下するので、多数の小氷塊を生じてペースト中を浮遊し、製品が不均一となる。したがってらいかい機を用いる時は、冷凍すり身を少くとも冷蔵庫温度まで品温を上昇させるべく解凍することが必要であった。

一方、サイレントカッター等回転刃によりせん断するタイプのものは、氷塊があっても破碎するから、より低温かららいかい出来るが、凍結品をせん断する時に発生する騒音や振動が激しいため、完全解凍もしくは半解凍のうしろらいかいするのが

普通である。

本発明者らは種々研究の結果、冷凍すり身の解凍品温は低い程製品品質が向上し、特に、 $-20^{\circ}\text{C}$ 以下で冷凍品をそのまません断らいかいすると製品の品質が飛躍的に向上することを見出した。

ここで述べる品温とは、らいかい開始時のすり身の品温を意味し、らいかい開始後に変化する品温を意味するものではない。

製品の品質は、日本水産学会誌 Vol 36, 88~95 (1970) に記載の如く、破断強度と変型率とによって定まる。そのうち破断強度は魚肉以外の要因で調節可能であり、たとえば坐りやでん粉の添加により強度を増大させ、水や卵白の添加により強度を減少させることが出来る。この様に破断強度は容易に調節できるが、変型率を増大させることは随意には不可能である。変型率の増大は製品の食感をしなやかにし、水産ねり製品の特徴である弾力感を高める効果がある。一方変型率を減少させることは「もろい」食感を増加させ、好ましくない食感である。変型率の減少は、酸化剤の

(3)

ドソー等により薄片に切断しておけば更に有利である。

$-20^{\circ}\text{C}$ 以下の品温でらいかいを開始するに当り、食塩その他の副原料を予め添加しておく、品温の上昇が速やかで固型分の消失が速やかとなり有利である。らいかい開始後、暫時 $0^{\circ}\text{C}$ 以下を維持するが、この間は回転を止めると直ちに小氷塊を多数生ずるので、製品化には適さない。小氷塊の発生しなくなる $+5^{\circ}\text{C}$ 以上に達すれば製品に適しており、通常の方法により成型、加熱して製品化すればよい。ただし、品温が $+25^{\circ}\text{C}$ 以上になると、直ちに坐りを生ずるので、製品化の適温はおよそ $+5\sim 20^{\circ}\text{C}$ である。

なお、 $+5^{\circ}\text{C}$ より品温が上昇するにしたがって、製品の破断強度、変型率は若干増大し、 $+20\sim 25^{\circ}\text{C}$ を超えると急激に減少する。ピークは $+20\sim 25^{\circ}\text{C}$ 附近にあり、解凍温度の高低により若干変化する傾向がある。らいかい初期品温が低い程ピークの品温は低くなり、(1)無解凍で $+20^{\circ}\text{C}$ 附近、(3)完全解凍では $25^{\circ}\text{C}$ 附近と高くなった。

(5)

添加やpHの低下により容易に達成される。

以上のように、破断強度の増減と、変型率の減少は容易だが、製品品質の向上に最も寄与する変型率の増大は、人為的には極めて困難であった。

本発明者らは、冷凍すり身を解凍することなく、らいかいすることにより変型率の大きい、食感の優れた製品を得ることを見出し、本発明を完成した。

本法を実施するために使用する冷凍すり身は、スケソウ、グチ、ホッケ等を原料とする、水産ねり製品に通常使用される冷凍すり身には全てに適用される。

本法を実施する装置は、サイレントカッター、ステファンカッター等、高速回転刃により魚肉をせん断する装置は全て使用しうる。ただしらいかい機は、せん断操作がないので、本法は適用できない。

本法実施に当り、凍結状態のすり身ブロックをそのまま用いても良いが、振動や騒音を避けるために、冷凍すり身をフローゼン・カッター、パン

(4)

次に、実施例により詳細に説明する。

実施例 1.

第1表の配合により蒲鉾を製造した。冷凍助宗すり身は(1)無解凍( $-25^{\circ}\text{C}$ )、(2) $5^{\circ}\text{C}$ の冷蔵庫中に4時間静置、(3) $5^{\circ}\text{C}$ の冷蔵庫中で1夜静置したものをを用いた。(1)はフローゼンカッターで薄片としたもの、(2)、(3)は厚さ約5 cm、巾約5 cm、長さ約20 cmの棒状にしたものをを用いた。

装置はステファンカッター VM-12 型回転数 1,500 rpm を用い、すり身は各3 kgを使用した。別にすり身1.5 kgを用い同一配合で石川攪潰機 20号でらいかいしたが、この場合は(3)の $5^{\circ}\text{C}$ 1夜解凍したすり身のみである。

配合装の原料を全てらいかい開始時に投入し、らいかいを開始してから一定時間毎に品温を測定し、サンプリングを行なって30 mmにケーシングして直ちに $85^{\circ}\text{C}$ 30分水浴中で加熱し、流水中で冷却後 $5^{\circ}\text{C}$ の冷蔵庫中に1夜保存したのち、厚さ30 mmに切断してレオメーター、7 mmφプランジャーで破断強度および変型率を測定した。

(6)

結果を第1図及び第2図にらいかい時間と品温の変化を、第3図～第6図に破断強度と変型率の変化を示した。

第1図はステファンカッターによる品温の変化を示す。黒点は温度を測定した点であり、数字があるのは物性測定用のサンプルを採取した点である。品温が0℃以下では小氷塊があるので、製品化しても不均一になるので、サンプリングは品温がプラスになってから行なった。

解凍の有無に拘らず、品温がプラスになった後は、何れも同様な温度上昇曲線を描く。しかし未解凍でスタートした(1)は0℃以下で様相の異なる温度変化を示す。即ち、無解凍は12分間-3～0℃を維持する。これは氷の融解熱が著るしく大きいいため、実際の品温はより低いにも拘らず、測定のため回転を止めると瞬時に水が氷となって熱を貯えるため、ほぼ同じ品温を維持すると考えられる。

第3図～第5図に物性の変化を示す。何れも、らいかい開始から次第に破断強度、変型率を増大  
(7)

い。これは<sup>お</sup>図に見られる通り、無解凍のため品温マイナスで11分もらいかいしているの、らいかい時間としては最早充分であることを示している。

搗潰機による物性変化は第6図の如く、ヒステリシス曲線はえがくがその動きの範囲は狭い。ピーク的位置は第3図、第4図のピーク的位置よりも変型率において低い。ピークのらいかい時間は約1時間であり(第2図)、らいかい時間としては充分である。このことから、解凍による製品品質の劣化は、変型率の減少となって表われ、破断強度についてはあまり影響しない様に思われる。

第5図、完全に冷蔵温度に達して高速せん断した場合、変型率は搗潰機と同等で、破断強度が小さい。これは第1図から明らかな様に、初発温度が高いためにらいかい時間が不十分なうちにピークを過ぎたためと判断される。

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し、およそ25℃でピークとなり、次いで破断強度、変型率ともに減少する、恰もヒステリシス曲線の如き変化を示す。ピークは直ちに坐りを起す点である。ピークの品温はすり身の初期品温が低い方がやや低くなる傾向があるが、後述の如く初期品温が-20℃以下の未解凍の方が魚肉の品質レベルが高いために、坐りが速やかに進行しやすくなるためと推定される。

解凍条件の相違によって破断強度、変型率のピーク的位置が異なり、解凍温度が低い程ピークが大であって、無解凍が最も大であった。同一の冷凍すり身を用いても、解凍の有無、条件によって製品品質に大きな影響を与え、解凍しない場合、製品品質が向上することを見出した。

これから推測されることは、冷凍すり身を解凍するということは、魚肉の品質を劣化させているのであって、その程度は冷凍品温から冷蔵品温に近づく程著るしい。

なお、第3図のサンプル1が既に強度、変型率とも相当大なる位置にあり、当初からピークに近  
(8)

#### 実施例2.

第2表の配合により蒲鉾を製造した。すり身は(1)無解凍(品温-23℃)で、バンドソーにより厚さ0.5～1cm、たて横各5cm程度に切断したものの、(2)実施例1(3)と同様にして5℃に1夜静置解凍したものを用いた。

らいかい装置はサイレントカッター(花木製作所、H260型)を用い、回転数1,500rpmとした。すり身を粉碎したのち、5分毎に実施例1と同様に処理した。また、25～30分らいかい後ケーシングし、10℃に2,4,6時間坐らせた後85℃30分加熱し、以下同様に測定した。

品温の変化を第7図に、物性の変化を第8図に示す。無解凍区は完全解凍区にくらべらいかい直後加熱で、全体に破断強度、変型率ともに大である(第8図)。ヒステリシス曲線の中から坐らせると、破断強度と変型率が坐り時間とともに増大するが、特に破断強度の増加が著るしい。

(1)無解凍区と(2)完全解凍区の坐りへの影響は、坐りによる物性変化の傾向が同じなので、出発点

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の変型率の大きい(1)の方が全般に変型率が高い。  
次に、(1)は6時間まで平均して破断強度が増大するが、(2)では2時間で坐りの進行が止まり、破断強度が増加しなくなる。

この現象は、らいかい開始時のすり身の品温が、坐りの能力にも影響していることを示している。  
(1)の坐り4時間、6時間の製品は、著るしくしなやかで、破断強度が $1.5 \text{ kg/cm}^2$ 近傍であるにも拘らずソフトで、最高に好ましい食感であった。

第1表 配合表

冷凍助宗すり身 SA	1.000
食 塩	30
ね り 味 *)	10
み り ん	30
馬鈴しでん粉	100
氷 水	500
合 計	1.670

\*) 味の素株式会社製調味料

第2表 配合表

冷凍助宗すり身 SA	8.000g
食 塩	240
ね り 味 *)	80
み り ん	240
卵 白	1.600
氷 水	1.600
合 計	11.760g

\*) 味の素株式会社製調味料

(11)

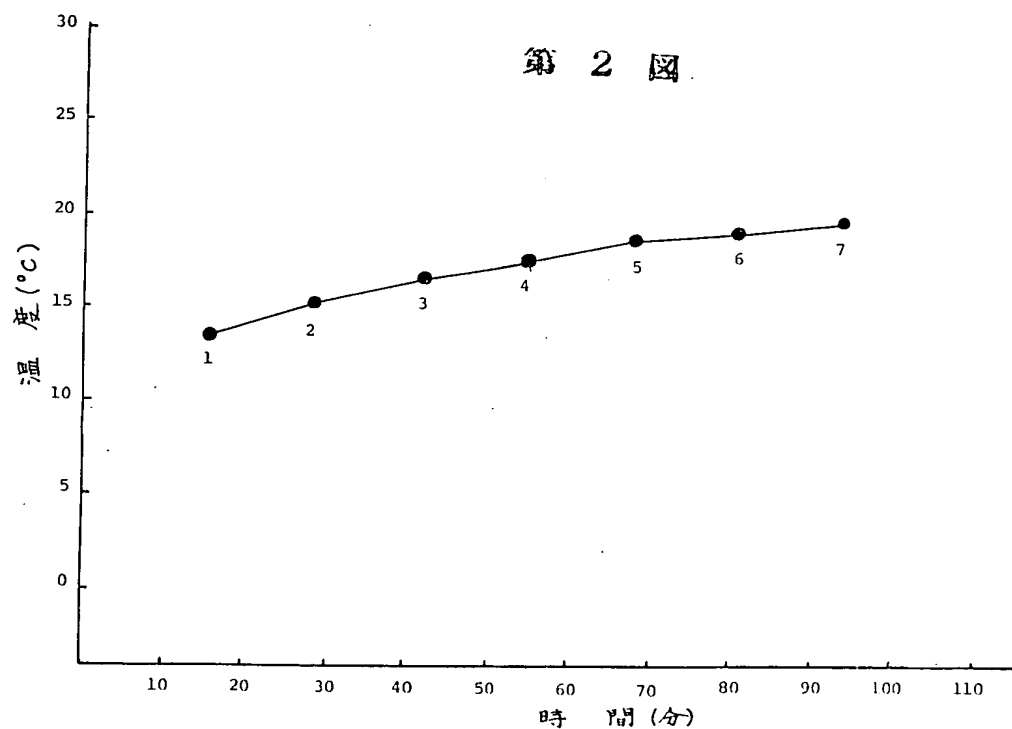
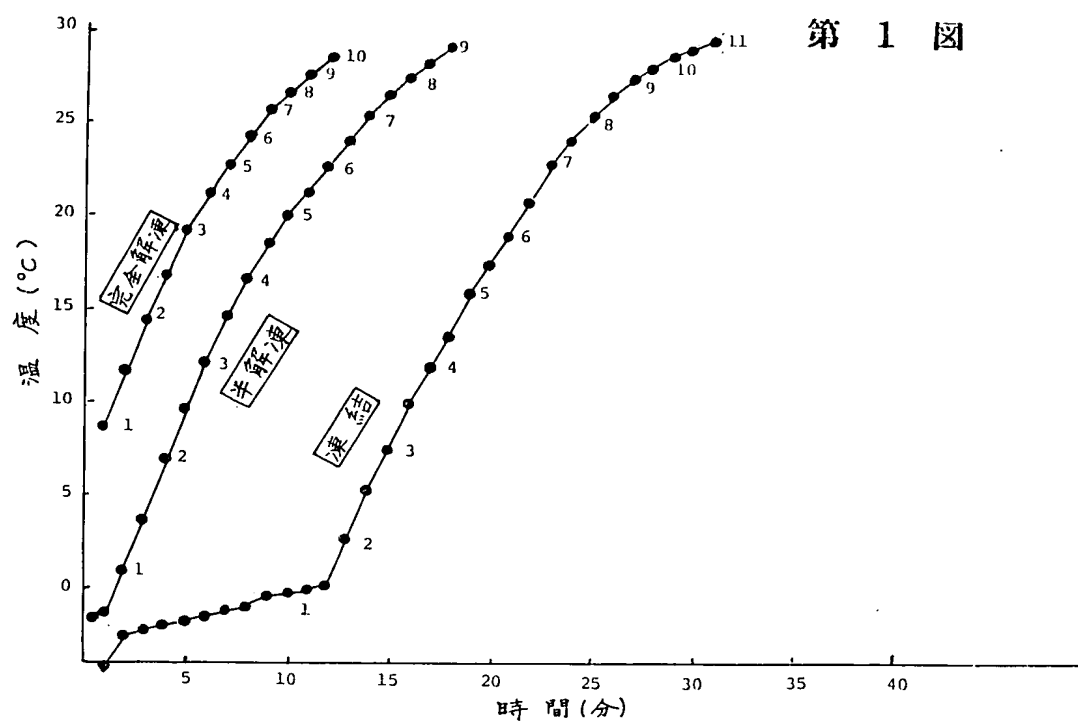
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## 4. 図面の簡単な説明

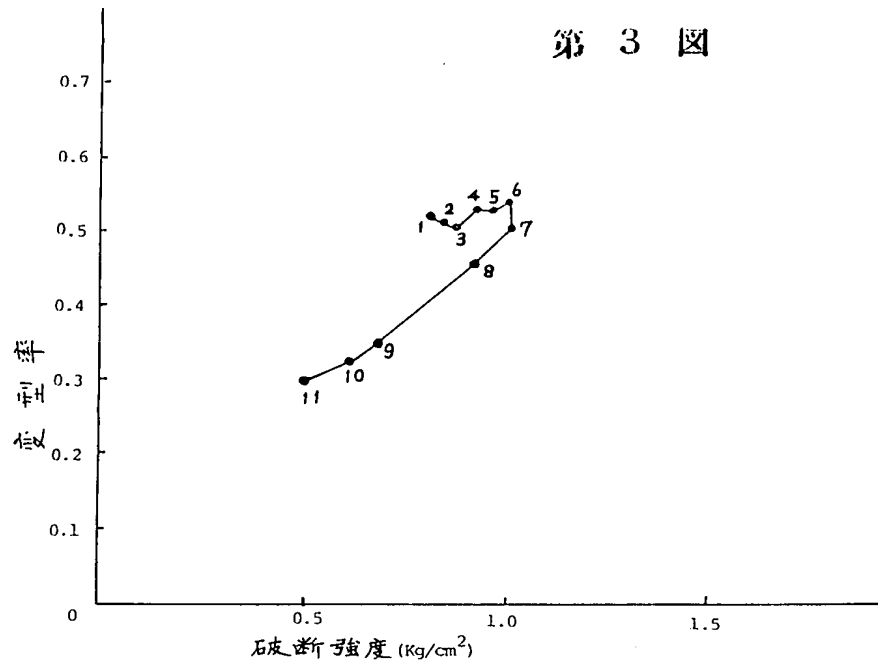
第1図はステファンカッターによるらいかい時間と品温の変化、第2図はらいかい機によるらいかい時間と品温の変化、第3図は未解凍品のステファンカッターによる物性の変化、第4図は半解凍品のステファンカッターによる物性の変化、第5図は完全解凍品のステファンカッターによる物性の変化、第6図は完全解凍品のらいかい機による物性の変化、第7図はサイレントカッターによるらいかい時間と品温の変化、第8図はサイレントカッターによる未解凍品と完全解凍品の物性の変化をそれぞれ示す。

特許出願人 味の素株式会社

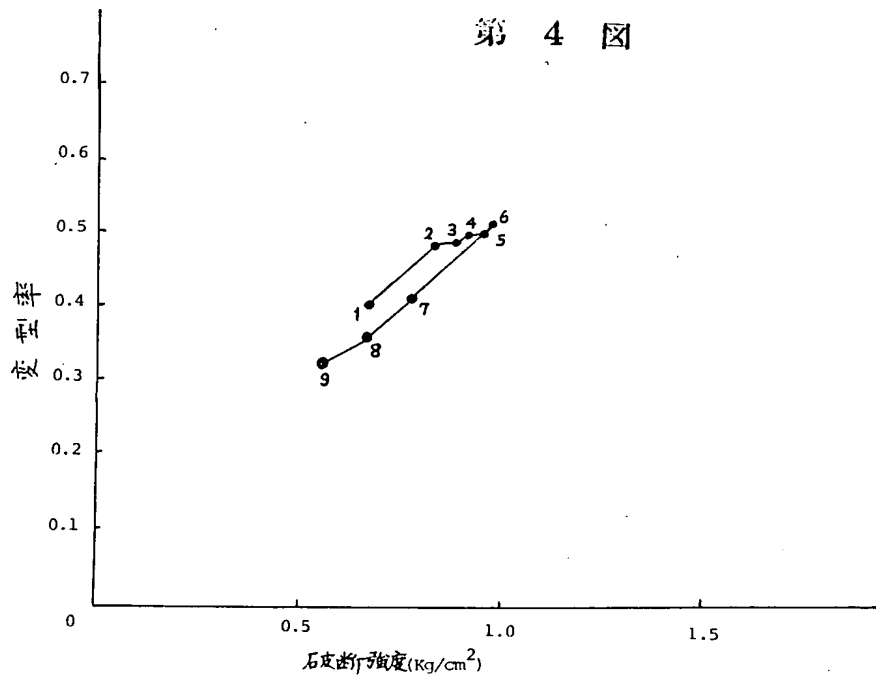
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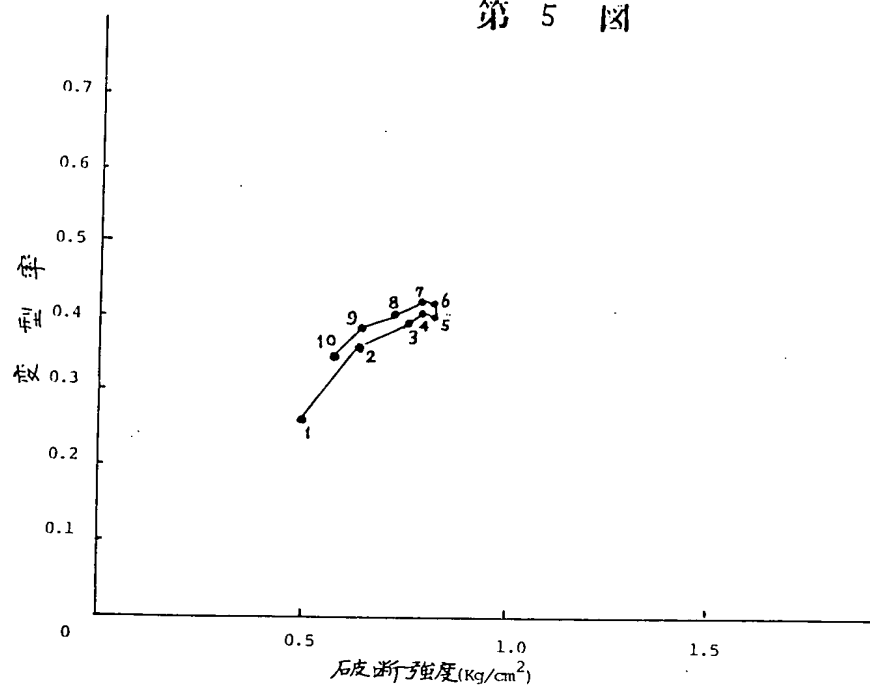
第 3 図



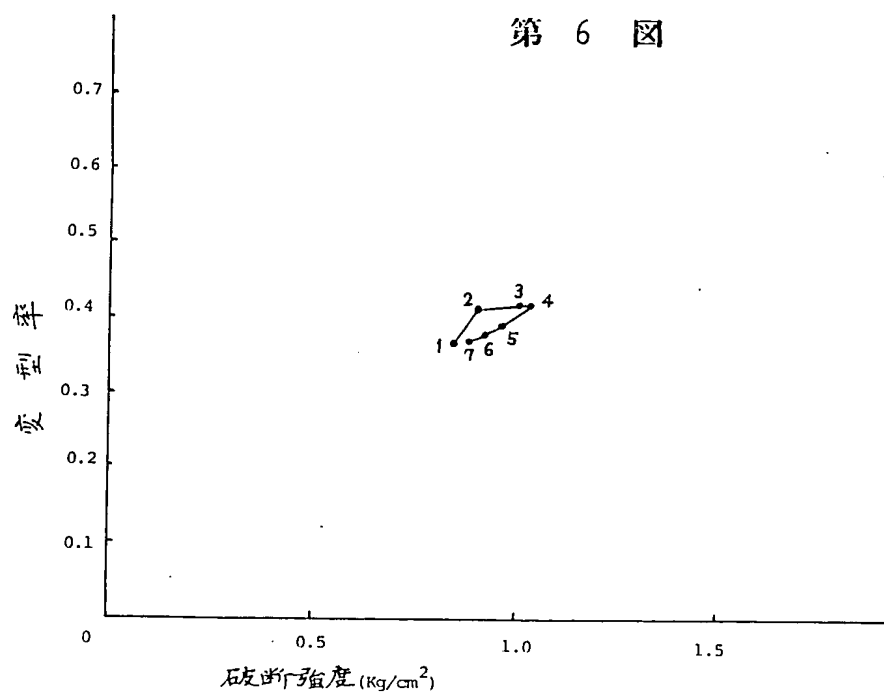
第 4 図



第 5 図

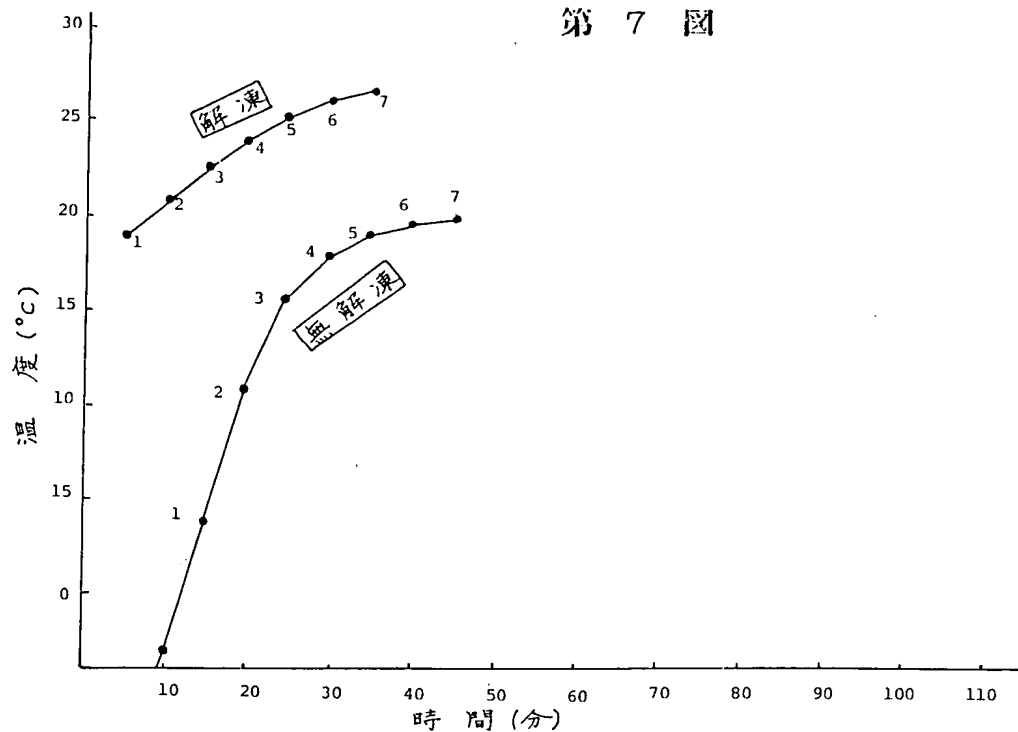


第 6 図

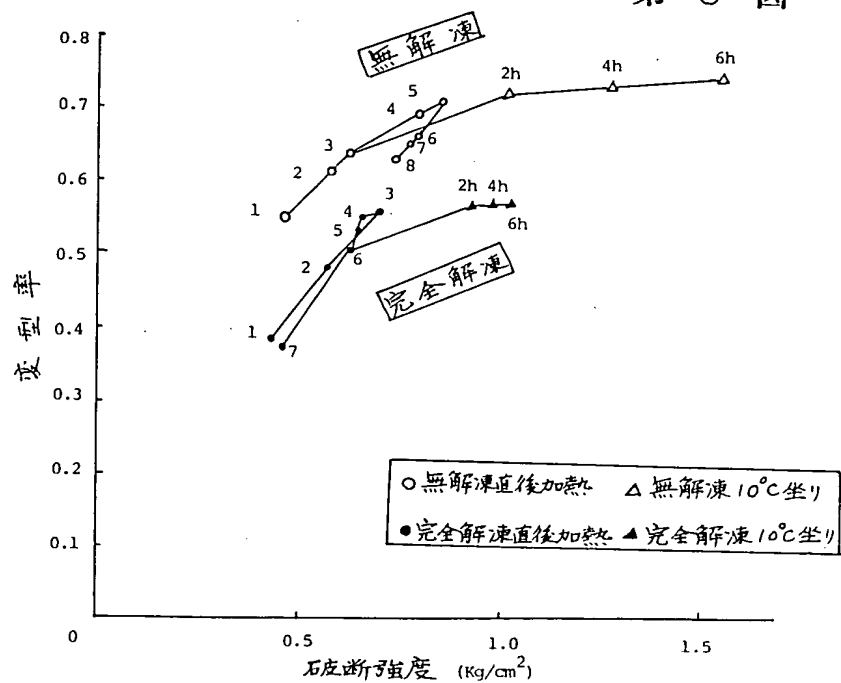




第 7 圖



第 8 圖



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paste  
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Specification

1. Title of the Invention

A method for producing fish paste products

2. Claim

A method for producing fish paste products characterized in that frozen ground fish meat is sheared and ground while keeping the said meat at the start of the grinding in a frozen state by setting its temperature at -20°C or below.

3. Detailed Description of the Invention


Fish paste product is referred to Japanese traditional food inherited from ancient times, and has conventionally been produced by kneading ground fish meat with common salt and other materials in a grinding machine. Recent practices are more likely to adopt, rather than the grinding machine, a variety of cutters having blades

rotating at a high speed, where their operations and actions remained almost similar to those of the grinding machine. That is, fish meat is kneaded with common salt to allow salting-in proteins eluted, and the obtained ground fish meat is appropriately formed and then heated, which results in highly elastic products unlike the original fish meat.

Fish meat as a material has been collected from fish bodies, which might be followed by soaking in water as required, and then dewatered to be used immediately. It becomes, however, quite rare in recent years to use such fresh fish meat immediately, and instead, it has been becoming more general to use "frozen ground fish meat" as a material prepared by processing fish bodies at their production sites and then rapidly frozen.

"Frozen ground fish meat" is distributed at  $-20^{\circ}\text{C}$  or below, and it is subjected to grinding after being thawed by, for example, allowing it to stand in a refrigerator or at room temperature, or further by heating in a electromagnetic thawing device. Since the grinding effected in a grinding machine will reduce the material temperature by approx.  $2^{\circ}\text{C}$  due to added salt, many tiny ice blocks can generate and drift in the paste unless the material temperature is set at not lower than  $+3^{\circ}\text{C}$ , which will result in inhomogeneous products. Thus, for the case with a grinding machine, it has been necessary to thaw ground fish meat so that the material temperature could rise at least up to refrigerating temperature. X

On the other hand, a sort of machine equipped with a rotating shear blade, such as a silent cutter, is available for the grinding even at lower temperature since it can crash ice blocks if they should occur, but it can generate awful noise and vibration in the shearing process for the frozen material. It is thus common practice to grind the material after being thoroughly thawed or half-thawed.

The present inventors have found from a series of investigations that the lower the temperature of the thawed ground fish meat goes, the higher the quality of the product becomes, and that in particular shearing and grinding the material as frozen at  $-20^{\circ}\text{C}$  or below would result in remarkably improved quality of the products. 

1 The material temperature denoted in this specification means temperature of the ground fish meat at the start of the grinding, rather than temperature variable after the start of the grinding.

Quality of the products depends on rupture strength and deformation ratio as discussed in Journal of Japanese Fishery Association Vol.36, 88-95 (1970). The rupture strength is adjustable with factors other than fish meat; occurrence of setting or addition of starch will raise the strength, and addition of water or glair will lower it. Unlike the rupture strength readily  
(10) adjustable, the deformation ratio cannot be altered arbitrarily. Raising the deformation ratio will improve elastic touch typical to ground fish meat products, but lowering it will increase uncomfortable "brittle" touch of tasting. Lower deformation ratio is easily attainable by adding oxidizing agent or lowering pH.

As described in the above, it has been easy to increase or decrease the rupture strength and to decrease the deformation ratio, but has been very difficult to artificially increase the deformation ratio which can contribute most effectively in improving the product quality.

20 The present inventors found that the frozen ground fish meat subjected to the grinding without being thawed resulted in the products with higher deformation ratio and excellent tasting touch, to complete this invention.

30 Frozen ground fish meat used in implementing a method of this invention is any of those ordinarily used in producing ground fish meat products originated from walleye pollack, croaker, Atka mackerel and so forth.

40 Machines available in this invention is silent cutter, Stephan's cutter or any of those shearing fish meat with a high-speed rotating blade. Whereas a grinding machine, effecting no shearing operation, is not available in this method.

Although frozen ground fish meat block in its entirety is allowable in implementing the present method, it may still more be advantageous if the frozen ground fish meat is processed into thin  
(50) strips using a frozen cutter, band saw and so on.

It is also beneficial to previously add common salt or any other

sub-materials before starting the grinding at a material temperature of  $-20^{\circ}\text{C}$  or below, since it can allow rapid rise of the material temperature to accelerate disappearance of solid components. The temperature is kept at not higher than  $0^{\circ}\text{C}$  for a while after the start of the grinding, where stopping the rotation will adversely affect production since a number of tiny ice blocks will immediately emerge. Temperature not lower than  $+5^{\circ}\text{C}$ , where no tiny ice blocks can appear, is suitable for the production which is followed by forming and heating according to usual processes. Temperature of  $+25^{\circ}\text{C}$  or above, however, will immediately cause setting. Thus a preferable range of the production temperature is between approx.  $+5$  to  $20^{\circ}\text{C}$ .

Rupture strength and deformation ratio somewhat increase as the temperature rises beyond  $+5^{\circ}\text{C}$  and abruptly drop beyond  $+20$  to  $25^{\circ}\text{C}$ . The peak values are given in the vicinity of  $+20$  to  $25^{\circ}\text{C}$  and tend to vary to a small extent depending on the thawing temperature. It was found that the material temperature corresponding to the peak became lower as the initial material temperature in the grinding was lowered, where the peak appeared at (1)  $+20^{\circ}\text{C}$  for the unthawed and (2) as high as  $25^{\circ}\text{C}$  for the full-thawed.

The next paragraphs will describe examples in detail.  
Example 1.

*Kamaboko* (a kind of boiled fish paste) was produced according to a blending as listed in Table 1. Frozen ground fish meat of walleye pollack was used in three ways as (1) unthawed ( $-25^{\circ}\text{C}$ ), (2) allowed to stand in a refrigerator at  $5^{\circ}\text{C}$  for 4 hours, and (3) allowed to stand overnight in a refrigerator at  $5^{\circ}\text{C}$ . The meat (1) was cut into thin strips using a frozen cutter and meats (2) and (3) were shaped into sticks of approx. 5 cm thick, approx. 5 cm wide and approx. 20 cm long.

Stephan's cutter Model VM-12 with a rotating speed of 1,500 rpm was used and charged with 3 kg of each meat. Another 1.5 kg portion of the ground fish meat, but only such that (3) allowed to

stand overnight at 5°C, was also ground according to the same blending using a Ishikawa Mixing Machine No.20.

All materials listed in the blend list were thrown into the cutter at the start of the grinding, material temperature was measured at a regular interval, the material was sampled, put into a 30 mm diameter case, which is immediately followed by boiling in hot water at 85°C for 30 min, cooled in running water, stored overnight in a refrigerator at 5°C, and cut in a thickness of 30 mm to be subjected to measurement of rupture strength and deformation ratio using a rheometer and 7 mm diameter plunger.

Changes in material temperature vs. time were shown in Figs. 1 and 2, and relations between rupture strength and deformation ratio were shown in Figs. 3 to 6.

Fig. 1 shows changes in the material temperature for the case with Stephan's cutter. The dots correspond to points of temperature measurement, among which numbered dots correspond to points of sampling for the measurement of the physical properties. Because tiny ice blocks appear at 0°C or below and could result in inhomogeneous product, the sample was collected only when the material temperature rose above 0°C.

Irrespective of being thawed or unthawed, all cases showed similar temperature ascending curves after the material temperature went above 0°C. Only the case (1) started unthawed, however, showed different temperature profile at and below 0°C. That is, the unthawed sample was kept at -3 to 0°C for 12 min. It is supposed that, when the rotation is ceased for the temperature measurement, the water immediately solidified to produce ice, heat of melting of which is exceptionally large, and stored heat, so that the material temperature appeared to be kept at almost constant despite an actual material temperature was more lower.

Figs. 3 to 5 show changes in the physical properties. All cases showed changes almost similar to a hysteresis curve, in which the rupture strength and deformation ratio gradually increased from the start of the grinding, peaked at approx. 25°C, and the both values

decreased afterward. The peak is a point where setting will immediately occur. The peak material temperature was likely to become somewhat lower as the initial material temperature of the ground fish meat became lower. This was supposed to be due to accelerated setting since, as described later, a better quality level of the fish meat was found in the case of the unthawed meat with the initial material temperature not higher than  $-20^{\circ}\text{C}$ .

The rupture strength and deformation ratio peaked at different positions for individual thawing conditions, where higher peak was given by lower thawing temperature, and the maximum by the unthawed. It was thus found that product quality is strongly affected by presence or absence of thawing or by its conditions even if the same frozen ground fish meat was used, and that improved product quality was obtained for the unthawed.

What is presumable from the fact is that thawing the frozen ground fish meat degrades quality of the fish meat and that its extent becomes more eminent as the material temperature varies from freezing temperature toward refrigerating temperature.

Meanwhile, sample 1 shown in Fig.3 is already located at a position corresponding to a relatively high rupture strength and deformation ratio, which is almost close to the peak. This indicates that, as shown in Fig.1, the unthawed sample has already been ground for as long enough as 11 min. below  $0^{\circ}\text{C}$ .

Changes in the physical properties by the grinding machine also show, as illustrated in Fig.6, a hysteresis curve but with a smaller range of variation. A position of the peak is lower than those in Figs. 3 and 4 in terms of deformation ratio. Grinding time corresponded to the peak is approx. one hour (Fig.2), which is long enough for the grinding. It is thus supposed that degradation of the product quality is mainly reflected to reduced deformation ratio and less reflected to rupture strength.

Fig.5 shows a case of high-speed shearing after fully thawed to reach the refrigerating temperature, where deformation ratio is similar to that obtained by a grinding machine while rupture strength is remained small. This may because, as is clear from

Fig.1, the peak had already been passed before the grinding reached a sufficient level due to a relatively high starting temperature. Example 2.

Kamaboko was produced according to a blending as shown in Table 2. The frozen ground fish meat was used in two ways as (1) unthawed (material temperature of  $-23^{\circ}\text{C}$ ) and cut into pieces of 0.5 to 1 cm thick and 5 cm square, and (2) allowed to stand overnight at  $5^{\circ}\text{C}$ , similarly to case (3) in Example 1. X

A Silent cutter (product of Hanaki Seisakusho, Model H260) was used for grinding at a rotating speed of 1,500 rpm. The ground fish meat was crushed and then treated in every 5 minutes similarly as described in Example 1. Another processing relates to the grinding for 25 to 30 min., casing, setting at  $10^{\circ}\text{C}$  for 2, 4 or 6 hours, boiling at  $85^{\circ}\text{C}$  for 30 min and similar measurements. X

Changes in the material temperature and physical properties are shown in Figs. 7 and 8, respectively. The unthawed group heated immediately after the grinding shows rupture strength and deformation ratio generally higher than those of the fully thawed group (Fig.8). Setting from halfway of the hysteresis results in increases both in the rupture strength and deformation ratio with the setting time, and the increase is more noticeable in the rupture strength.

As for effects of the setting on the (1) unthawed group and (2) fully-thawed group, the deformation ratio is larger in general for (1) with a larger deformation ratio at the starting point, since varying tendency of the physical properties is almost equal for both groups. The rupture strength increases on an average until after 6 hours for material (1), whereas stops increasing after 2 hours for material (2) due to cessation of the setting.

These phenomena indicate that the temperature of the ground fish meat at the start of the grinding also affects setting capability. Material (1) after 4- and 6-hour settings appeared as very flexible and provided the best tasting touch despite the rupture strength being remained at around  $1.5 \text{ kg/cm}^2$ .



Table 1 Blend List

Frozen ground walleye pollack meat SA	1,000g
Common salt	30
Neriaji *)	10
Sweet cooking sake	30
Potato starch	100
Ice water	500
Total	1,670

\*) Flavoring product of Ajinomoto Co., Inc.

Table 2 Blend List

Frozen ground walleye pollack meat SA	8,000g
Common salt	240
Neriaji *)	80
Sweet cooking sake	240
Glair	1,600
Ice water	1,600
Total	11,760

\*) Flavoring product of Ajinomoto Co., Inc.

#### 4. Brief Description of the Drawings

Fig.1 shows changes in material temperature vs. time of grinding using Stephan's cutter; Fig.2 shows changes in material temperature vs. time of grinding using a grinding machine; Fig.3 shows changes in physical properties of an unthawed material processed with Stephan's cutter; Fig.4 shows changes in physical properties of a half-thawed material processed with Stephan's cutter; Fig.5 shows changes in physical properties of a fully-thawed material processed with Stephan's cutter; Fig.6 shows changes in physical properties of a fully-thawed material processed with a grinding machine; Fig.7 shows changes in material temperature vs. time of grinding using a silent cutter; and Fig.8 shows changes in physical properties of unthawed and fully-thawed materials processed with a silent cutter.

Applicant Ajinomoto Co., Inc.

Fig.1

Temperature ( $^{\circ}\text{C}$ )

Time (minute)

fully thawed

half-thawed

frozen

Fig.2

Temperature ( $^{\circ}\text{C}$ )

Time (minute)

Fig.3, Fig.4, Fig.5, Fig.6

Deformation ratio

Rupture strength ( $\text{kg}/\text{cm}^2$ )

Fig.7

Temperature ( $^{\circ}\text{C}$ )

Time (minute)

thawed

unthawed

Fig.8

Deformation ratio

Rupture strength ( $\text{kg}/\text{cm}^2$ )

unthawed

fully thawed

○ heated immediately as frozen

△ setting at  $10^{\circ}\text{C}$  as frozen

● heated immediately after fully thawed

▲ setting at  $10^{\circ}\text{C}$  after fully thawed